

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Ochrosia haleakalae*

COMMON NAME: Holei

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

☐ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined):

September 19, 1997

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or

continuance of candidate status.

- ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- ___ F – Range is no longer a U.S. territory.
- ___ I – Insufficient information exists on biological vulnerability and threats to support listing.
- ___ M – Taxon mistakenly included in past notice of review.
- ___ N – Taxon does not meet the Act’s definition of “species.”
- ___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Apocynaceae (Dogbane family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Maui and Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Maui and Hawaii

LAND OWNERSHIP: *Ochrosia haleakalae* occurs on State and private land.

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LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION

Species Description

Ochrosia haleakalae is a tree 6.7 to 26.3 feet (ft) (2 to 8 meters (m)) tall. The elliptic leaves are clustered three or four per node. Tubular flowers occur in relatively open inflorescences. Robust, ovoid drupes are yellow or plum-colored, streaked with brown and often have irregular ridges at maturity due to differential thickening of the exocarp (Wagner *et al.* 1999).

Taxonomy

Ochrosia haleakalae was described by St. John (1978). This species is recognized as a distinct taxon in Wagner *et al.* (1999, p. 218), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History

Typical habitat is dry to mesic, and sometimes wet, forest, often on lava, at elevations between 2,300 and 4,000 ft (700 and 1,200 m) (The Nature Conservancy (TNC) 2006; Wagner *et al.* 1999). On East Maui, the species occurs in diverse mesic and wet forest (Medeiros *et al.* 1986; TNC 2006; A. Medeiros, U.S.G.S, Biological Resources Discipline (USGS-BRD), pers. comm. 2007). On the island of Hawaii, *Ochrosia haleakalae* is known from gulches and valleys in the Hamakua district and from degraded *Metrosideros polymorpha*-*Pisonia sandwicensis* (ohia-papala kepau) mesic and forest in the Kohala Mountains (Perlman and Wood 1996; Wagner *et*

al. 1999; TNC 2006).

Historical Range

Historically *Ochrosia haleakalae* was known from two islands, Maui and Hawaii. On Maui the species was known to occur from the Koolau and Makawao Forest Reserves (FRs), the north slope of Haleakala, and from Auwahi and Kanaio on the southern slopes of Haleakala volcano (Hawaii Biodiversity and Mapping Program (HBMP) 2008). On the island of Hawaii the species was known from valleys in the Kohala mountains (Pololu, Honopue, and Waipio) and from Kalopa gulch on the eastern (Hamakua) slope of Mauna Kea volcano (HBMP 2008).

Current Range/Distribution

Ochrosia haleakalae is currently known from Makawao FR and Auwahi/Kanaio on the island of Maui, and from Kohala FR (Honopue gulch), Waipio, Hilo FR (Laupahoehoe section), Hamakua FR (Kalopa gulch), and at Hawaii Volcanoes National Park on the island of Hawaii (L. Pratt, USGS-BRD, pers. comm. 2005; N. Agorastos, Hawaii Division of Forestry and Wildlife (DOFAW), pers. comm. 2007; A. Medeiros, pers. comm. 2007; HBMP 2008; H. Oppenheimer, Plant Extinction Prevention Program (PEP), pers. comm. 2008).

Population Estimates/Status

This species is currently known from eight populations on Maui and Hawaii totaling between 64 to 76 wild individuals. Four populations occur on east Maui and four populations occur on the island of Hawaii (L. Pratt, pers. comm. 2005; HBMP 2008; N. Agorastos pers. comms. 2007, 2010; K. Bio, PEP, pers. comm. 2008). On the island of Maui 15 individuals are known from a population on private land at Auwahi (with 123 more outplanted individuals), and approximately 44 individuals occur inside the Makawao FR (USGS-BRD 2006; A. Medeiros, pers. comm. 2007; H. Oppenheimer, pers. comms. 2005, 2008). On the island of Hawaii, 11 individuals are known from a population on private land in Alakahi gulch, 1 individual is found at Kailikaula Stream, 2 individuals are at Kalopa gulch, and 3 are found along Blair Road. The status of the individuals at Kailikaula Stream and Alakahi Gulch are uncertain since the earthquake in 2006 (N. Agorastos, pers. comm. 2010). More than 100 have been outplanted at Kipuka Puauulu and Kipuka Ki in Hawaii Volcanoes National Park (L. Pratt, pers. comm. 2005; N. Agorastos, pers. comm. 2007; HBMP 2008; K. Bio, pers. comm. 2008).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. *Ochrosia haleakalae* is highly and imminently threatened by feral pigs (*Sus scrofa*) on both islands, and by goats (*Capra hircus*) and cattle (*Bos taurus*) on Maui (H. Oppenheimer, pers. comm. 2004; HBMP 2008). Evidence of the activities of feral pigs, goats and cattle has been reported in areas where *O. haleakalae* is known to occur (A. Medeiros, pers. comm. 1995; H. Oppenheimer pers. comm. 2004; N. Agorastos, pers. comm. 2007).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State to optimize hunting opportunities

(Tomich 1986; State of Hawaii 2001). In a study conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui, the deleterious effects of feral pig rooting on native forest ecosystems was documented (Diong 1982). Kipahulu Valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* (koa) and/or *Metrosideros polymorpha* (ohia). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 inches (20 centimeters), greatly disrupting the leaf litter and topsoil layers, and contributing to erosion and changes in ground topography. The feeding habits of pigs were observed to create seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, Molokai, and Hawaii. Goats browse on introduced grasses and native plants, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. Goats are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al.* 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). A study of goat predation on the native *Acacia koa* (koa forest) on the island of Hawaii has shown that grazing pressure by goats can cause the eventual extinction of koa because it is unable to reproduce (Spatz and Mueller-Dombois 1973). An exclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of koa (Spatz and Mueller-Dombois 1973). Another study at Puuwaawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, koa and *Metrosideros* spp. seedlings were observed geminating by the thousands (Department of Land and Natural Resources 2002).

Cattle, the wild progenitors of which were native to Europe, northern Africa, and southwestern Asia, were introduced to the Hawaiian Islands in 1793. Large feral herds developed as a result of restrictions on killing cattle decreed by King Kamehameha I. While small cattle ranches were developed on Kauai, Oahu, and west Maui, very large ranches of tens of thousands of acres were created on east Maui and Hawaii. Feral cattle can presently be found on the islands of Hawaii and Maui, and ranching is still a major commercial activity. Cattle eat native vegetation, trample roots and seedlings, cause erosion, create disturbed areas into which alien plants invade, and spread seeds of alien plants in their feces and on their bodies. The forest in areas grazed by cattle becomes degraded to grassland pasture, and plant cover is reduced for many years following removal of cattle from an area. Several alien grasses and legumes purposely introduced for cattle forage have become noxious weeds (Tomich 1986; Cuddihy and Stone 1990).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs, goats, and other introduced ungulates (Loope *et al.* 1991). Because of demonstrated habitat modifications by feral pigs, goats, and cattle, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants, the U.S. Fish and Wildlife Service (Service) believes they are potential threats to *Ochrosia*

haleakalae.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

Ochrosia haleakalae is potentially threatened by feral pigs on both islands, and by goats and cattle on Maui at all but three locations (A. Medeiros, pers. comm. 1995; H. Oppenheimer pers. comm. 2004; L. Pratt pers. comm. 2005; USGS-BRD 2006; N. Agorastos pers. comm. 2007). Browsing by ungulates has been observed on many native plant species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al.* 1991). Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980; Lamoureux 1994).

Pigs are omnivorous in their diet. In the study described above on feral pig populations in the Kipahulu Valley, pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982). A stomach content analysis showed that the pigs' food sources consisted of native plants, 60 percent of which were tree ferns (*Cibotium* spp.), alternating with *Psidium cattleianum* when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species (herbaceous and woody plants), with larger trees killed over a few months of repeated feeding.

Predation and habitat degradation by goats is a potential threat where populations of *Ochrosia haleakalae* occur on Maui (Brueggmann *in litt.* 1995; HBMP 2008). Feral goats eat native vegetation, are able to forage in extremely rugged terrain, and have a high reproductive capacity. Elimination of rare native plants such as *Argyroxiphium kauense* and *A. sandwicense* ssp. *sandwicense* (Hawaiian silverswords), *Canavalia kauensis* (awikiwiki), and a number of Maui species (*Stenogyne microphylla*, *Schiedea haleakalaensis*, *Plantago princeps*), from areas heavily foraged by goats has been documented (Cuddihy and Stone 1990).

The ability of cattle to degrade native vegetation by grazing and trampling was recognized very soon after large-scale ranching began in Hawaii (Cuddihy and Stone 1990). Therefore, even though we have no evidence of direct browsing for *Ochrosia haleakalae*, predation by feral pigs, goats, and cattle is a potential threat to this species.

D. The inadequacy of existing regulatory mechanisms.

Ochrosia haleakalae is not currently protected under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pigs and goats are managed in Hawaii as game animals, but many animals populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Pig and goat hunting is allowed year-round, or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting does not adequately control the number of ungulates to eliminate this

threat to native plant species. Hunting of feral cattle is no longer allowed in Hawaii (Hawaii Department of Land and Natural Resources 1985) except under permitted conditions.

E. Other natural or manmade factors affecting its continued existence

Fire is a major threat to *Ochrosia haleakalae*, and is exacerbated by the presence of introduced plant species such as *Pennisetum clandestinum* (kikuyu grass) (HBMP 2008). Because Hawaiian plants were subjected to fire during their evolution only in areas of volcanic activity, or from occasional lightning strikes, they are not adapted to recurring fire regimes and do not quickly recover following a fire. Alien plants are often better adapted to fire than native plant species, and some fire-adapted grasses such as kikuyu grass have become widespread where *O. haleakalae* occurs (D'Antonio and Vitousek 1992; Friefelder *et al.* 1998; HBMP 2008). The presence of such species in Hawaiian ecosystems greatly increases the intensity, extent, and frequency of fire, especially during the drier months or periods of drought. Fire can destroy dormant seeds as well as plants, even in steep or inaccessible areas. Fires may result from natural causes, or they may be accidentally or intentionally started by humans (Cuddihy and Stone 1990; D'Antonio and Vitousek 1992; Friefelder *et al.* 1998).

In addition to fire, *Ochrosia haleakalae* is threatened by alien plant species that degrade and destroy habitat and outcompete native plants (HBMP 2008). The nonnative plants that are reported to be the greatest threats to *O. haleakalae* on the island of Maui are *Asclepias physocarpa* (balloon plant), *Cestrum diurnum* (day jessamine), *Fraxinus uhdei* (tropical ash), *Pennisetum clandestinum*, *Psidium cattleianum* (strawberry guava), *Rubus argutus* (prickly Florida blackberry), and *Setaria palmifolia* (palm grass) (A. Medeiros, pers. comm. 2004; F. Starr, U.S.G.S.-BRD, pers. comm. 2006; HBMP 2008;). Nonnative plants which pose the greatest threats to *O. haleakalae* on the island of Hawaii are *Aleurites moluccana* (kukui), *Clidemia hirta* (Koster's curse), *Hedychium coronarium* (white ginger), *Psidium cattleianum*, *Psidium guajava* (common guava), *Rubus rosifolius* (thimbleberry), *Setaria palmifolia* (palm grass), and *Toona ciliata* (Australian red cedar) (L. Perry, DOFAW, pers. comm. 2006; HBMP 2008).

Aleurites moluccana is a spreading tree 33 to 65 ft (10 to 20 m) tall, native to Malesia, and considered a Polynesian introduction to Hawaii. It is now a significant component of the mesic valley vegetation from sea level to 2,300 ft (700 m) on all the main islands (Wagner *et al.* 1999). This species favors moist valleys; however, it is now growing in seemingly totally inaccessible spots (Pacific Island Ecosystems at Risk (PIER) 2006a). The Hawaii Weed Risk Assessment Protocol places *A. moluccana* in the high risk category (PIER 2006a).

Asclepias physocarpa is native to South Africa and in Hawaii is naturalized in low elevation, dry habitats, occasionally up to 6,000 ft (1,830 m) on all islands except Niihau and Molokai (Wagner *et al.* 1999).

Cestrum diurnum is a tall shrub native to the West Indies, cultivated for its fragrant flowers, and is now naturalized on Kauai, Oahu, and Molokai. This species invades dry and wet areas and forms dense thickets. Seeds are dispersed by birds; however the seeds are poisonous to humans and other mammals (Florida Exotic Pest Plant Council 2006).

Clidemia hirta is a noxious shrub first cultivated in Wahiawa on Oahu before 1941. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a serious plant threat (Wagner *et al.* 1985; Smith 1989). The most promising biological control to date for Koster's curse is the *Colleotrichum* fungus, *Gloesporioides* f. sp. *clidemiae*, released in 1986. Although there is no quantitative data available, it has an observable negative impact. Other agents tested were a moth (*Antiblemma acclinalis*), a leaf-feeding beetle (*Lius poseidon*), a fruit and flower-feeding insect (*Mompha trithalama*), and a terminal growth-feeding insect (*Liothrips urichi*), all with lesser control success than the fungus (Smith 1989).

Fraxinus uhdei is a tree up to 92 ft (28 m) tall, native to central and southern Mexico and introduced to Hawaii by the thousands in the 1900s as forestry plantings (Wagner *et al.* 1999, p. 991). This species disrupts native habitat due to copious seed production, prolific seedling recruitment, rapid early growth, and shade tolerance (Tunison 1991, p. 1). It forms single species stands, and can spread downstream and down slope from plantings. The Pacific Island Ecosystems at Risk (PIER) species risk analysis places *F. uhdei* in the high risk category (PIER 2009).

Hedychium coronarium is native to India and favors wet habitats including rainforest, moist forest, roadsides, open areas, and sides of streams. In Hawaii it is frequently cultivated and naturalized in mesic forest (Wagner *et al.* 1999). Its creeping growth overwhelms low-growing plants in pastures and forests (Motooka *et al.* 2002).

Pennisetum clandestinum is from tropical eastern Africa, and is found on all major Hawaiian Islands from 1,640 to 6,560 ft (500 to 2,000 m) in dry and mesic habitats. It will also invade wet environments when the forest is disturbed (Smith 1985). Kikuyu grass is one of the most serious pest species threatening native vegetation; its smothering, thick, dense growth prevents virtually any new seedling establishment (Holm *et al.* 1977; Wagner *et al.* 1999).

Psidium cattleianum, a tree native to tropical America, has become widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, strawberry guava develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985; Wagner *et al.* 1985). A biological control agent, *Tectococcus ovatus*, has undergone 15 years of testing, and there is a proposal to release this insect at Olaa Forest Reserve on the island of Hawaii (ScienceDaily 2008).

Psidium guajava, a small shrub or tree native to the Neotropics, is naturalized in Hawaii and forms dense stands in disturbed forest. It is not as common as *P. cattleianum*. The seeds are spread by feral pigs and alien birds (Wagner *et al.* 1999). Extensive stands of young trees must be controlled through burning, as cutting results in regrowth with multiple stems. Regeneration from underground parts by suckering limits the effectiveness of manual control. Trees grown from seed produce fruit in 2 to 4 years, with a life expectancy of 30 to 40 years (Global Invasive Species Database 2006a).

Rubus argutus is native to the central and eastern United States, and is a serious weed that

naturalizes in a variety of disturbed habitats (Tunison 1991). It reproduces both vegetatively and by seed (Tunison 1991). *Rubus argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Tunison 1991; Wagner *et al.* 1999). This taxon grows via runners underground, and readily resprouts from them if above ground tissue is treated with herbicide (U.S. Army 2006). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986).

Rubus rosifolius is native to Asia and is common in Hawaii in disturbed mesic to wet forest on all of the main islands. It is a sparse shrub, covered with prickles, and has edible red fruit. It invades the understory, forming dense thickets and outcompetes native plant species. It easily reproduces from roots left in the ground, and seeds are spread by feral animals and birds. There is no specific management information for *R. rosifolius*, but techniques used for the control of *R. fruticosus* (blackberry) which is a related species, may be applicable (PIER 2006b; Global Invasive Species Database 2006b).

Setaria palmifolia is native to tropical Asia, and was first collected on Hawaii Island in 1903 (O'Connor 1999). A large-leafed perennial herb, this species attains about 6.5 ft (2 m) in height at maturity, shading out native vegetation. Palmgrass is resistant to fire and recovers quickly after being burned. Feral animals provide new areas for establishment by disturbing and opening areas in native vegetation (Cuddihy and Stone 1990). Chemical control methods are used currently, and no known biocontrol research is being conducted for this species (Motooka *et al.* 2003).

Toona ciliata is a fast-growing tree, 66 to 98 ft (20 to 30 m) tall. It is native to India, southeastern Asia, and Australia, and is cultivated as a timber tree. In Hawaii it was first collected on Oahu in 1929, and was extensively planted. Australian red cedar is a well-branched shade tree with an open spreading crown. It has wind-dispersed seeds and is naturalized in mesic to wet disturbed habitats on Maui, Hawaii, Kauai, Oahu and Lanai (Koala Native Plants 2006).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total current native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 species are pests (Smith 1985; Wagner *et al.* 1999). Confirmed personal observations (HBMP 2008) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *Ochrosia haleakalae*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al.* 2004). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1997). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to that of *O. haleakalae* the Service believes nonnative plant species are a threat to this species.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

A population of approximately 15 wild trees and 123 outplanted individuals has been fenced and is being managed on private lands in Auwahi on Maui (USGS-BRD 2006; A. Medeiros, pers. comm. 2007). Two populations are fenced and managed on the island of Hawaii: one population of 3 wild trees is in the Hilo FR (Laupahoehoe section) (N. Agorastos, pers. comm. 2007), and the other is a reintroduced population of more than 100 trees at Hawaii Volcanoes National Park (L. Pratt, pers. comm. 2005). Nonnative plant control is ongoing within all of the protected areas (L. Pratt, pers. comm. 2006; USGS 2006; N. Agorastos, pers. comm. 2007).

This species is represented in an ex situ collection at the Volcano Rare Plant Facility and seeds are in refugia at Lyon Arboretum Seed Bank (Service 2005; Volcano Rare Plant Facility 2008; Lyon Arboretum Seed Bank Inventory 2008).

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs, goats, and cattle, and by the potential for habitat loss due to fire, and competition with nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Ochrosia haleakalae* due to fire and competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs, goats, and cattle are potential threats to *O. haleakalae*. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Protect all individuals from feral pigs, goats, and cattle
- Control alien plants
- Protect populations from fire
- Conduct field surveys for additional populations in suitable habitat
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species
- Propagate and maintain genetic stock

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2*
	Non-imminent	Subspecies/population	3
		Monotypic genus	4
		Species	5
Moderate to Low	Imminent	Subspecies/population	6
		Monotypic genus	7
		Species	8
	Non-imminent	Subspecies/population	9
		Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This species is highly threatened by feral pigs, goats, and cattle that degrade and destroy habitat. Two of the largest populations of this species are highly threatened by fire, and nonnative plants, such as *Pennisetum clandestinum*. Three populations of approximately 200 outplanted individuals are protected from ungulates and nonnative plants (L. Pratt, pers. comm. 2006; USGS-BRD 2006; N. Agorastos, pers. comm. 2007). Nonnative species add to the fuel load, replace native species after fire, and compete with *Ochrosia haleakalae* for light, space, and nutrients. Threats to the dry to mesic forest habitat of *O. haleakalae*, and to individuals of this species, occur throughout its range and are expected to continue or increase without protection from fire, control or eradication of non-native animals, and control of nonnative weeds.

Immediacy of Threats:

Habitat degradation by feral pigs, goats, and cattle, and the potential for fire and competition with nonnative plants are imminent threats because they are ongoing. Possible predation by feral ungulates is considered non-imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, three populations of *Ochrosia haleakalae* are benefiting from ungulate exclosure fencing and nonnative plant control. If it becomes apparent that the routine listing process is not

sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *O. haleakalae* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING

Much of the information on this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Arthur Medeiros, USGS-BRD in 1995 and 1999. The form has also been updated with information from a Service-funded survey by the National Tropical Botanical Garden in 1995. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2006, the Pacific Islands office contacted the following species experts: Forest Starr, Pacific Islands Ecosystems at Risk, and Lyman Perry, Hawaii Division of Forestry and Wildlife. New status and range information was provided in 2007 by Patty Moriysau, Volcano Rare Plant Facility, and Nick Agorastos, Hawaii Division of Forestry and Wildlife, and Art Medeiros, USGS-BRD, and was incorporated into this assessment. In 2008 new status and range information was received from Hank Oppenheimer, Plant Extinction Prevention Program, for populations on Maui. In 2009 we received no new information. In 2010, we contacted the species experts listed below, and received new information from Nick Agorastos, DOFAW.

List all experts contacted:

Name	Date	Affiliation
Agorastos, Nick	02/09/10	Division of Forestry and Wildlife
Anderson, Stephen	02/09/10	National Park Service, Haleakala NP, Maui
Aruch, Sam	02/09/10	private contractor
Bakutis, Ane	02/09/10	Plant Extinction Prevention Program, Molokai
Ball, Donna	02/09/10	U.S. FWS, Partners Program, Hawaii Island
Beavers, Sally	02/09/10	National Park Service, Hawaii Island
Bily, Pat	02/09/10	The Nature Conservancy, Maui
Bio, Kealii	02/09/10	Plant Extinction Prevention Program, Hawaii Island
Brosius, Chris	02/09/10	West Maui Mountains Watershed Partnership
Caraway, Vickie	02/09/10	Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan	02/09/10	Plant Extinction Prevention Program, Oahu
Cole, Colleen	02/09/10	Three Mountain Alliance
Conry, Paul	02/09/10	Hawaii Department of Land and Natural Resources
Coordinator	02/09/10	East Maui Watershed Partnership
Duvall, Fern	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri	02/09/10	The Nature Conservancy, Maui
Garnett, Bill	02/09/10	National Park Service, Kalaupapa, Molokai
Giffin, Jon	02/09/10	The Nature Conservancy, Hawaii Island
Haus, Bill	02/09/10	National Park Service, Haleakala NP, Maui
Higashino, Jennifer	02/09/10	U.S. FWS, Maui
Imada, Clyde	02/09/10	Bishop Museum
Jacobi, Jim	02/09/10	U.S.G.S., Biological Resources Division

Kawakami, Galen	02/09/10	Division of Forestry and Wildlife, Kauai
Kawelo, Kapua	02/09/10	U.S. Army, Environmental Division
Kier, Matt	02/09/10	U.S. Army, Environmental Division
Kiyabu, Brian	02/09/10	Amy Greenwell Botanical Garden
Kraus, Jim	02/09/10	U.S. FWS, Hakalau NWR
Medeiros, Arthur	02/09/10	U.S. Geological Survey
Misaki, Ed	02/09/10	The Nature Conservancy, Molokai
Moriyasu, Patty	02/09/10	Volcano Rare Plant Facility, Hawaii Island
Moses, Wailana	02/09/10	The Nature Conservancy, Molokai
Nakai, Glynnis	02/09/10	U.S. FWS, Refuges, Maui
Oppenheimer, Hank	02/09/10	Plant Extinction Prevention Program, Maui Nui
Palomino, Anna	02/09/10	Olinda Rare Plant Nursery, Maui
Palumbo, David	02/09/10	National Park Service, Haleakala NP, Maui
Pepi, Vanessa	02/09/10	U.S. Navy, Environmental Contractor
Perlman, Steve	02/09/10	National Tropical Botanical Garden
Perry, Lyman	02/09/10	Division of Forestry and Wildlife, Hawaii Island
Plunkett, Bryan	02/09/10	Lanai Forest and Watershed Partnership
Pratt, Linda	02/09/10	U.S.G.S., Biological Resources Division
Purell, Melora	02/09/10	Kohala Watershed Partnership
Seidman, Stephanie	02/09/10	Maui Nui Botanical Garden
Shishido, Glenn	02/09/10	Division of Forestry and Wildlife, Maui
Silbernagle, Mike	02/09/10	U.S. FWS, Refuges, Oahu
Smith, Miranda	02/09/10	Koolau Mountains Watershed Partnership
Starr, Forest	02/09/10	U.S. Geological Survey
Tanaka, Daniel	02/09/10	Puu Kukui Watershed Preserve
Ward, Joe	02/09/10	Puu Kukui Watershed Preserve
Welton, Patti	02/09/10	National Park Service, Haleakala NP, Maui
Wood, Ken	02/09/10	National Tropical Botanical Garden
Wysong, Michael	02/09/10	DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (facing a very high risk of extinction in the wild) (Brueggemann and Caraway 2003). *Ochrosia haleakalae* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al.* 2005).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. We received new information from Nick Agorastos.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Cecylia D. Bohan 5/18/10
Regional Director, Region 1, Fish and Wildlife Service Date

Ronan W. Gould
ACTING
Director, Fish and Wildlife Service October 22, 2010

Concur:

Do not concur: _____ Date: _____
Director, Fish and Wildlife Service

Director's Remarks:

Date of annual review: _____ Date: April 21, 2010
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 23, 2010
Prelisting and Listing Program Coordinator

Marilet Zablan Date: April 26, 2010
Assistant Field Supervisor, Endangered Species Division

Gina Shultz Date: April 30, 2010
Acting Field Supervisor